GB1332995

Title:
HYDRAULIC FLUSHING APPARATUS FOR DISCHARGING FLUID FROM A COANTAINER AND AUTOMATICALLY REFILLING SAME

Abstract:

1332995 Flushing apparatus GIBBS PLUMBING CO Inc 13 Jan 1971 1685/71 Heading E1C In flushing apparatus of the kind employing a sealed tank 3 which is permanently connected to a pressure liquid supply by a pipe 4, preferably incorporating a check valve (5, Fig. 1, not shown), and wherein discharge is effected by raising a valve head 19 from a seat 20 by manually operable means, e.g. a handle (33, Fig. 1, not shown) acting on a link rod 36 to lift a lever 28 having a pin- and-slot connection with a rod 21, the valve head 19 moves within a cylinder 16 having an orifice 39 communicating with the tank and containing a piston 23 which is urged downwardly by a spring 27 against the pressure in the tank, the upper part of the cylinder being vented at V to atmosphere. In operation, raising of the valve head 19 from the closed position shown to a position above the orifice 39 releases the liquid from the tank, the discharge being assisted as pressure in the tank drops by the downward movement of the piston 23. A venting tube 7 is provided having a ball valve 9 and an orifice 12 whose effective area can be varied by rotating an apertured cap 14.

PATENT SPECIFICATION (11) 1 332 995

DRAWINGS ATTACHED

(19)

1 332 995

(21) Application No. 1685/71 (22) Filed 13 Jan 1971

(44) Complete Specification published 10 Oct. 1973

(51) International Classification E03D 3/10

(52) Index at acceptance
E1C 21G2A 21G2B 21G2F2 21G2P

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(54) HYDRAULIC FLUSHING APPARATUS FOR DISCHARGING FLUID FROM A CONTAINER AND AUTOMATICALLY REFILLING SAME

(71) We, GIBBS PLUMBING, INC., a corporation duly organized and existing under the laws of the State of Florida, United States of America, of 260 West 21st Street, Hialeah, State of Florida, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates in general to water flushing apparatus and more particularly to a combination of a tank, valve and piston for rapidly flushing water or other liquid from the tank and automatically refilling same.

Prior flushing apparatus commonly used to flush toilets depended upon the gravitation of water from a tank open to the atmosphere by manually opening a large diameter valve, commonly called a "Fuller ball", and refilling the tank with pressurized water under the control of an inlet valve operated by a float means. This form of flush apparatus is wasteful of water and not always effective in rapidly forcefully flushing and cleaning the toilet bowl.

According to one aspect of the invention there is provided a hydraulic flushing apparatus for filling and rapidly discharging a liquid from a flushing tank, said apparatus comprising a hermetically sealed tank disposed in said flushing tank, a cylinder having an open lower end and a cap on the upper end thereof associated with said sealed tank and positioned in vertical relation therewith, said cylinder having an orifice in the side wall thereof opening into the lower portion of said tank to provide a water passage to the said open lower end thereof, a circular valve seat extending around the inner periphery of said cylinder positioned below said orifice, a valve having a circular head with a coaxial upstanding stem slidably positioned in said cap for vertical movement of said head from an open position above said orifice to a closed position below said orifice with the said head thereof in sealed engagement with said seat, said apparatus including a piston coaxially and slidably positioned on said valve stem in said cylinder for movement from a downward position above said orifice to a predetermined upper position against a stop means on said stem, manual means operatively associated with said valve for moving said valve from said closed to said open position, a spring in said cylinder positioned between the inner surface of said cap and the upper surface of said piston for urging the latter in a downward direction, an air vent valve in said tank sealed through the upper portion of said tank for automatic movement from a closed position when said tank is pressurized by liquid therein and adapted for gravity opening to the atmosphere when said tank is drained of liquid, a source of pressurized liquid including a supply conduit connected thereto, an inlet conduit of predetermined size sealed through the wall of said tank to supply said tank with pressurized said liquid, a check valve connected between said supply conduit and said inlet conduit to prevent the reverse flow of said liquid from said tank whereby the operation of said manual means will open said valve and permit said liquid to flow through said orifice and from said cylinder with the flow thereof augmented by the movement of said piston from its said upper to its said lower position for rapidly flushing said liquid from said tank through said orifice and from said cylinder.

According to another aspect of the invention there is provided a hydraulic flushing apparatus characterized by a hermetically sealed tank arranged in a flushing tank, a cylinder having an open lower end and a cap on the upper end thereof substantially vertically associated with said sealed tank and including an orifice in the side wall

[Price 25p]

thereof opening into the lower portion of said sealed tank, said cylinder having a valve seat around the inner periphery thereof positioned normal to the axis of, and at a predetermined distance below, said orifice, a valve having a circular head for sealed engagement on said seat when in closed position, said valve having a coaxial stem extending upward in said cylinder and axially slidable through said cap for moving said head to an open position above said orifice when said stem is raised, a piston slidably and coaxially positioned on the valve stem within said cylinder, and a spring for biasing said piston towards the lower end of the cylinder, the arrangement being such that when the valve is moved from the closed to the open position pressurized water in the sealed tank will be discharged through the open end of the cylinder.

Other objects and advantages in one embodiment of the invention are described and shown in the following specification and drawings, in which:

Fig. 1 shows an enclosed container and an associated toilet flushing apparatus positioned within a typical manually operated toilet flush tank with a portion thereof broken away;

Fig. 2 is a right side view of the apparatus shown in Fig. 1 with a portion broken away;

Fig. 3 is an enlarged fragmentary cross sectional view taken generally through section line 3—3, Fig. 2;

Fig. 4 is an exploded view of elements shown in Fig. 3;

Fig. 5 is a cross sectional view taken through section line 5—5, Fig. 1, showing the moving elements in idle position;

Fig. 6 is a front cross sectional view of the apparatus shown in Fig. 3 with the moving elements moved to discharge position;

Fig. 7 is a cross sectional view like Fig. 5 with the moving elements released for return to idle position.

Referring to Figs. 1 and 2, it is to be noted that the entire flushing apparatus is shown mounted within a conventional toilet flush tank 1, associated with a toilet bowl 2, illustrated by broken lines, where it may be used as a replacement for conventional flushing equipment or for many other purposes requiring intermittent fluid flushing action.

Figs. 1—4 show all of the elements of the apparatus to be described in detail.

A hermetically sealed container or tank 3 is secured in the flush tank 1, as shown, with a filler tube 4 connected through the upper portion of one side of the tank 3 and a check valve assembly 5 connected between the filler pipe and a tube 6 connected to a source of pressurized water, in this instance an average pressure in the order of thirty pound per square inch. An air vent tube 7 extends downward within the tank, best shown in Fig. 3, and is equipped with a seat 8 in the bottom thereof with a check ball 8 loosely retained in the lower end portion of the tube by a pin 10.

A disc 11 having an offset aperture 12 therein is coaxially secured to the upper end of tube 7 which is secured and sealed in vertical relation to tank 3 by a threaded bushing 13 on which a cap 14, having an offset aperture 15, is threaded. Adjustment of the cap 14 with respect to disc 11 will vary the effective cross section of the vent in the tank 3.

The adjustment of the aperture 15 in metering disc 14 with respect to aperture 13 in cap 12 provides an air vent of predetermined selected cross section for the tank 3, the action of which will be hereinafter described.

In this particular embodiment, a cylinder 16 is vertically secured and sealed by well known means through tank 3, as shown. The lower end portion or output end portion of the cylinder has threads 17 for sealed engagement with a bowl 2 or other means for conducting water therefrom.

A planar valve seat 18 is positioned around the inner periphery of the lower portion of the cylinder which is adapted to be engaged by an inverted circular valve head 19 having an elastomer rim 20 secured around the periphery of the valve for sealing engagement with the seat 18. The head 19 is secured to a valve stem 21 by a thread means, as shown. The upper end portion of the stem 21 is slidably retained by a closure cap 22 threaded on the upper end of the cylinder and having a vent V for the free passage of air into and out of the cylinder.

A piston 23 is slidably retained within the cylinder 16 and slidably sealed by elastomer "O" rings 24. The piston has an axial bore therethrough for slidable retention on a lower portion of stem 21 and is slidably sealed thereon by an "O" ring 25. It is to be noted that the piston normally rests against a shoulder or stop 26 on the stem 21. A coil compression spring 27 is positioned coaxial with stem 21 within the cylinder 16 and positioned between the upper surface of piston 23 and the inside surface of cap 22 for urging the piston in a downward direction a predetermined distance from stop 26, the action of which will be hereinafter described. A valve lever or lifter 28 is pivotally secured at one end to a bracket 29 on cap 22 by a pin 30. A pin 31 through the upper end of the stem 21 is engaged through a cam slot 32 in the lifter 28, as shown.

Referring to Fig. 1, the lifter 28 in this particular embodiment is operated by a manual handle 33 with a shaft 34 thereof journalled through the wall of the tank ter-

minating in an internal lever 35. A link 36 has opposite ends pivotally connected to the outer end of lever 35 and the outer end of lifter 28, respectively.

It is now apparent that the downward movement of handle 33 will raise the lifter 28 and cam the valve stem 21 upward and raise the valve head 19 from the seat 18.

The upper end portion of the valve stem has an adjustment collar 37 threaded thereon with a spring 38 positioned between the collar and the upper side of the cap 22, as shown in Fig. 3, the action of which will be hereinafter described.

Referring to Fig. 5, the cylinder 16 has a relatively large elongated inlet orifice 39 positioned in the lower portion of the tank 3 for feeding the water into the lower portion of the cylinder when valve member 19 is in the raised or open position, as shown in Fig. 6.

Referring to Figs. 1, 3, and 5, and under the assumption that valve head 19 is in closed position and the tube 6 is connected to a source of pressurized water and the check valve has permitted the water to flow through tube 4 into tank 3, the ball 9 responding to displaced air will seat and hermetically seal the tank, which will fill with water against the compression of air above the water to a predetermined height and thus establish equilibrium. Simultaneously, the piston 23 will rise and compress spring 27 until arrested by the stop 26. It is to be noted that the piston 23 is held against the stop 26 of the valve stem 21 against the counter restraining action of spring 27 by the pressure within the tank.

When the handle 33 is manually moved downward, the valve lifter 28 and the valve stem 21 will first move upward by virtue of the camming action of the slot 32 against pin 31. During the movement of the valve head 19 from its seat 18 to a position above orifice 39, shown in Fig. 6, the water in tank 3 under the lower side of piston 23 will be rapidly forced downward by the rapid downward movement of the piston by the energy stored in spring 27, and assist the final downward movement of lever 33. When the valve has reached its full open position, shown in Fig. 6, the piston 23 will have descended to a position resting against the upper end of the valve head 19. This downward movement of the piston provides rapid motivation to the water discharge through orifice 39 and from the cylinder and the tank will empty rapidly because of the compressed air above the water and the added impetus of the downward movement of the piston 23.

Following the flushing of the toilet bowl and the release of the handle 33, the valve head 19 will descend by gravity and in order to maintain a necessary quantity of clean residual water in the bowl, the valve head 19 will be prevented from seating on seat 18 by a small distance D corresponding with the adjustment of collar 37.

Thus as the incoming pressurized water is fed to the tank through filler tube 4, a predetermined small portion of the water will flow through orifice 39 and around the valve head 19 and over the seat 18 into the bowl. This action will continue for a period determined by the adjustment of collar 37 on stem 21. Since the check valve 5 is automatically opened when the tank is emptied, it will remain open until a small pressure is built up within the tank while the bowl is being filled.

Since the inlet flow of pressurized water is much greater than the small outlet flow, the water will rise in the tank and create sufficient pressure to close valve head 19 against the seat 18 against the restraining action of spring 38 permitting water to flow into the tank and compress the air thereabove and fill the tank to a state of equilibrium equal to the water pressure whereupon the check valve 5 will close and the apparatus will be ready for a subsequent flushing operation.

It is apparent that the cylinder in the above described apparatus may be secured on any side of the tank at a sacrifice in overall space requirements.

It is to be understood that the flushing apparatus described may be used for many industrial operations with liquids other than water for industrial applications such as in connection with cleaning and plating apparatus. These uses will not necessarily require the use of the spring 38 and collar 37 for producing a residual flow, such as is required for toilet bowls.

This invention also comprehends such modifications in the above described construction as fall within the scope of the appended claims.

WHAT WE CLAIM IS:—

1. A hydraulic flushing apparatus for filling and rapidly discharging a liquid from a flushing tank, said apparatus comprising a hermetically sealed tank disposed in said flushing tank, a cylinder having an open lower end and a cap on the upper end thereof associated with said sealed tank and positioned in vertical relation therewith, said cylinder having an orifice in the side wall thereof opening into the lower portion of said tank to provide a water passage to the said open lower end thereof, a circular valve seat extending around the inner periphery of said cylinder positioned below said orifice, a valve having a circular head with a coaxial upstanding stem slidably positioned in said cap for vertical movement of said head from an open position above said orifice to a closed position below said orifice with the

said head thereof in sealed engagement with said seat, said apparatus including a piston coaxially and slidably positioned on said valve stem in said cylinder for movement from a downward position above said orifice to a predetermined upper position against a stop means on said stem, manual means operatively associated with said valve for moving said valve from said closed to said open position, a spring in said cylinder positioned between the inner surface of said cap and the upper surface of said piston for urging the latter in a downward direction, an air vent valve in said tank sealed through the upper portion of said tank for automatic movement from a closed position when said tank is pressurized by liquid therein and adapted for gravity opening to the atmosphere when said tank is drained of liquid, a source of pressurized liquid including a supply conduit connected thereto, an inlet conduit of predetermined size sealed through the wall of said tank to supply said tank with pressurized said liquid, a check valve connected between said supply conduit and said inlet conduit to prevent the reverse flow of said liquid from said tank whereby the operation of said manual means will open said valve and permit said liquid to flow through said orifice and from said cylinder with the flow thereof augmented by the movement of said piston from its said upper to its said lower position for rapidly flushing said liquid from said tank through said orifice and from said cylinder.

2. A hydraulic flushing apparatus according to claim 1, including a valve spring biased between said cap and the said stem of said valve for resiliently holding the said head of said valve a predetermined small distance from said seat whereby the release of said manual means will permit a predetermined small portion of the incoming pressurized water from said inlet conduit to continue to flow from said cap into said bowl to a predetermined residual height until the pressure in said tank is sufficiently high to overcome the tension of said valve spring and permit said valve head to engage said valve seat and simultaneously close said air vent valve and move the piston to its upper position by overcoming the tension of said piston spring and permitting the incoming water to fill the tank to a predetermined depth and compress the air trapped above the water for a subsequent flushing cycle.

3. A hydraulic flushing apparatus according to claim 1, including an air inlet valve for said flush tank comprising a tube sealed in the upper portion of said flush tank extending downward therein having a normally gravity opening check valve in the lower end thereof whereby atmospheric air will be admitted to the flush tank when said water is discharged therefrom and whereby the pressure of the incoming said pressurized water will close said valve when said flush tank is filled to a predetermined height permitting the said air above said water to be compressed to equal the pressure of said water.

4. A hydraulic flushing apparatus characterized by a hermetically sealed tank arranged in a flushing tank, a cylinder having an open lower end and a cap on the upper end thereof substantially vertically associated with said sealed tank and including an orifice in the side wall thereof opening into the lower portion of said sealed tank, said cylinder having a valve seat around the inner periphery thereof positioned normal to the axis of, and at a predetermined distance below, said orifice, a valve having a circular head for sealed engagement on said seat when in closed position, said valve having a coaxial stem extending upward in said cylinder and axially slidable through said cap for moving said head to an open position above said orifice when said stem is raised, a piston slidably and coaxially positioned on the valve stem within said cylinder, and a spring for biasing said piston towards the lower end of the cylinder, the arrangement being such that when the valve is moved from the closed to the open position pressurized water in the sealed tank will be discharged through the open end of said cylinder.

5. A hydraulic flushing apparatus according to claim 4, wherein said spring is biased between said cap and said piston for normally urging the latter to a predetermined lower idle position whereby the filling of the tank with pressurized water will raise said piston and energize said spring and whereby during the movement of said valve from said closed to said open position said piston will descend to said idle position and augment the flow of the said pressurized water from said tank via said cylinder.

6. A hydraulic flushing apparatus substantially as described and illustrated in the accompanying drawings.

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed. 1973.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1332995 COMPLETE SPECIFICATION
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Sheet 1

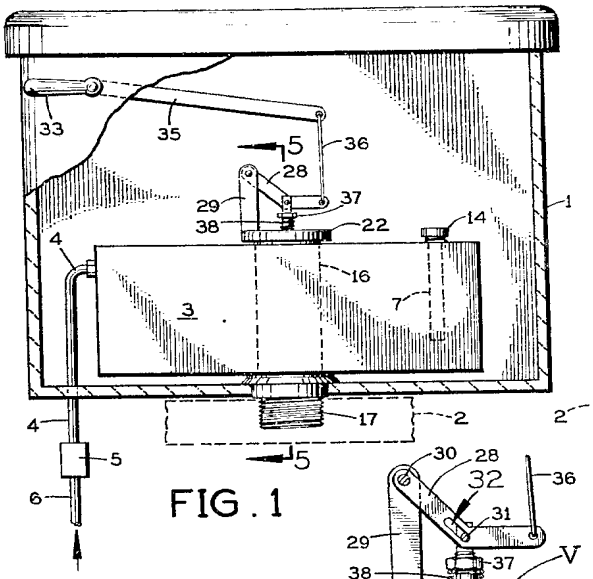

FIG. 1

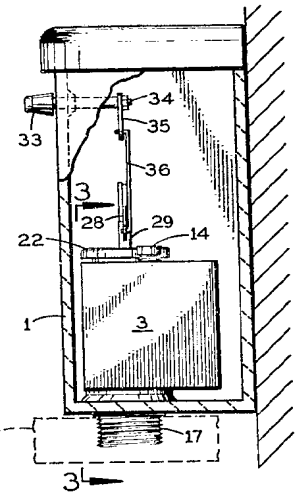

FIG. 2

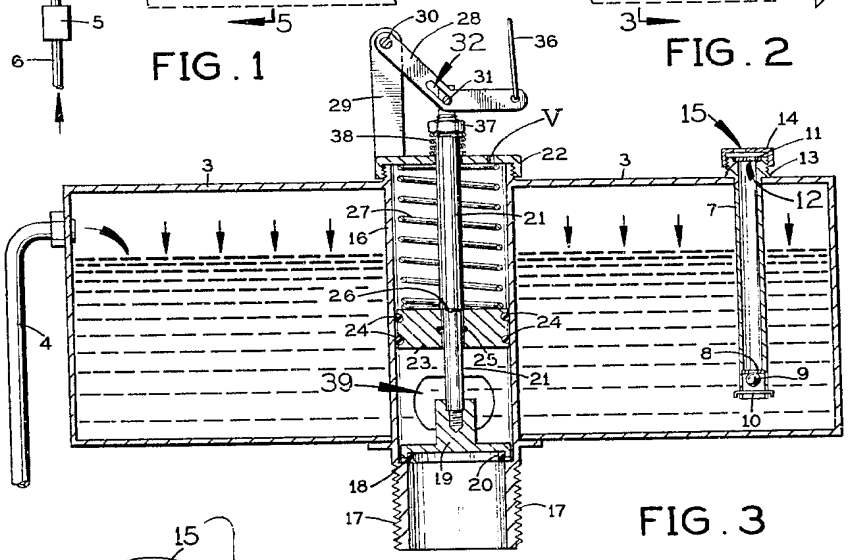

FIG. 3

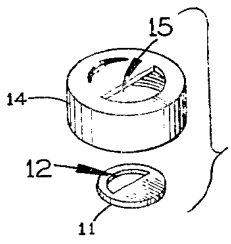

FIG. 4

1332995 COMPLETE SPECIFICATION
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Sheet 2

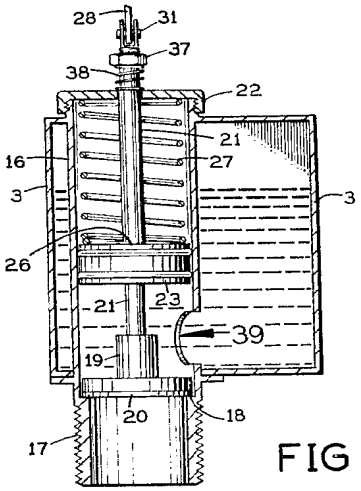

FIG. 5

FIG. 7

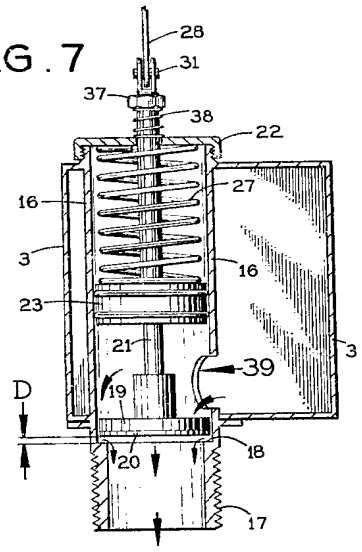

FIG. 6